

# **Solid State Lighting Program**

## **Commercialization Support Pathway**

**U.S. Department of Energy**

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Building Technologies Program  
Energy Efficiency and Renewable Energy  
U.S. Department of Energy



## **I. SSL R&D Investment Leads to Technology Commercialization**

The U.S. Department of Energy has a long-term commitment to develop and support commercialization of solid state lighting (SSL) for general illumination, including sources, fixtures, electronics, and controls. Title IX (Research and Development) of the Energy Policy Act of 2005 (EPACT 2005) directs the Secretary of Energy to carry out a Next Generation Lighting Initiative (NGLI) to support research, development, demonstration, and commercial application activities for SSL.

The Secretary is also directed to carry out research, development, demonstration, and commercial application activities through competitively selected awards. The Energy Act authorizes \$50 million to the NGLI for each fiscal year 2007 through 2009, with extended authorization to allocate \$50 million for each of the fiscal years 2010 to 2013. Actual appropriations are subject to the Congressional appropriations process.

This public R&D investment serves the ultimate goal to successfully commercialize the technologies in the buildings sector, where lighting accounts for more than 20 percent of total electricity use. Potential benefits are enormous if SSL technology achieves projected price and performance levels:

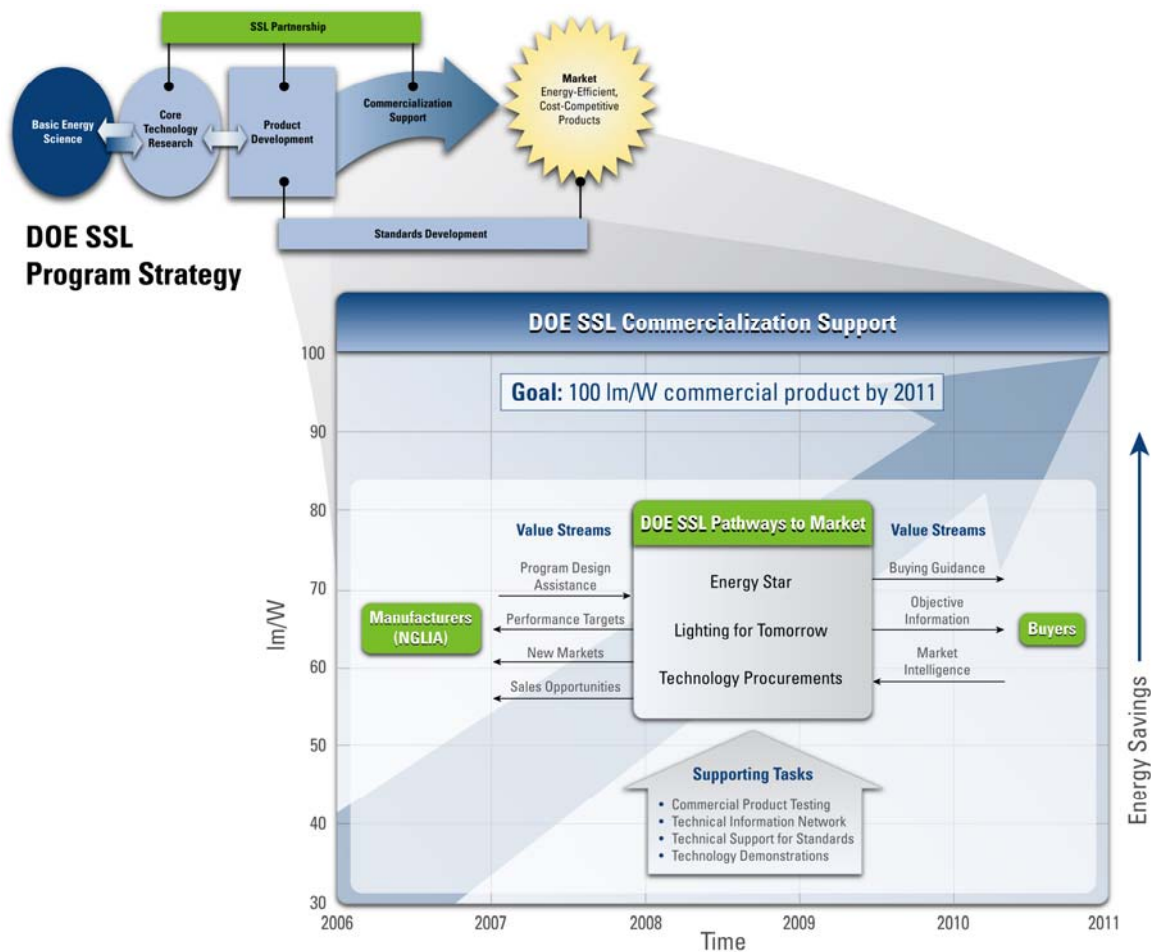
- In 2027, the annual energy savings from solid-state lighting would be approximately 348 terawatt-hours, or the equivalent annual electrical output of 44 large power plants. At today's energy prices, that would equate to more than \$30 billion in energy savings in that year alone.
- Total electricity consumption for lighting would decrease by roughly 33 percent relative to a scenario with no SSL in the market. These electricity savings are greater than the energy consumed to illuminate all the homes in the US today.
- Over the 20 year period from 2007 to 2027, cumulative energy savings are estimated to total about 3,019 terawatt-hours, representing about \$280 billion in cumulative energy savings at today's energy prices.

To realize the full promise of SSL, major research challenges must be addressed. DOE has a comprehensive strategy to accelerate the development and market introduction of energy-efficient white-light sources for general illumination. The figure below illustrates DOE's SSL Program Strategy. Unique attributes of SSL technologies underscore the importance of a long-term, coordinated approach encompassing applied research and strategic technology commercialization support.

Effective market introduction of SSL technologies must be informed by and coordinated with the applied research currently underway. Recent R&D advances have pushed white-light LED performance to levels that make them appropriate for use in some general illumination applications. DOE's commercialization support plan draws on a variety of strategies to assist the market introduction of high-quality, energy-efficient SSL technologies.

## II. Commercialization Support Activities

DOE is actively engaged in activities that support the commercialization of SSL technologies for use as general illumination sources. As a public agency DOE is able to provide support and guidance in several areas that move the SSL market toward the highest energy efficiency and highest lighting quality. DOE's on-going partnership with the SSL industry helps to connect R&D and product development activities to the market. DOE has organized its commercialization support activities in terms of pathways to the market, and supporting tasks needed to facilitate those pathways. The figure below expands the Commercialization Support area, showing the relationship of the activities to the luminous efficacy goals over time.



### ***SSL Industry Partnership***

EPACT 2005 directed DOE to partner, through a competitive selection process, with an industry alliance representing US-based SSL research, development, infrastructure, and manufacturing expertise. The legislation further directed DOE to seek industry input in identifying SSL technology needs, assessing the progress of research activities, and updating SSL technology roadmaps. In fulfillment of this directive, DOE signed a Memorandum of Agreement with the Next Generation Lighting Industry Alliance (NGLIA) in 2005. Alliance members include the major US-based manufacturers of LEDs, OLEDs, components, materials, and systems. Membership continued to grow in 2006, including increased participation by lighting fixture manufacturers. The Alliance provides regular feedback to DOE through bimonthly meetings, and has several topical subcommittees that provide technical input to support DOE activities such as the development of ENERGY STAR® criteria for SSL products, development of standards and test procedures, and updates to the DOE SSL R&D Multi-Year Program Plan.

### **A. Pathways to Market**

DOE is engaged in three key activities that serve as pathways to market for energy-efficient SSL technologies, as described below. These pathways speed introduction and adoption of energy-efficient technologies by providing a competitive advantage to products that are more efficient compared to standard technology.

### ***ENERGY STAR for SSL***

ENERGY STAR is a voluntary energy efficiency labeling program that helps consumers to identify products that save energy, relative to standard technology. DOE issued draft ENERGY STAR criteria for solid-state lighting (SSL) luminaires in December 2006. The proposed criteria include two categories: Category A covers a limited number of general illumination niche applications for which white LED systems are appropriate in the near-term, and Category B, which is intended to cover a wide range of LED systems for general illumination. Category B will serve as the longer term target for the industry. Initial applications eligible under Category A include those with the following characteristics: 1) appropriate for a light source with a directional beam, as opposed to a diffuse source; 2) low to moderate illuminance requirement; 3) illuminated task or surface relatively close to the light source; and 4) potential for cost-effective use of LED-based products in the near term. Initial Category A applications are: undercabinet lighting, portable desk/task lights, outdoor porch, pathway, and step lighting, and recessed downlights. For more information and ongoing updates, see: [http://www.netl.doe.gov/ssl/energy\\_star.html](http://www.netl.doe.gov/ssl/energy_star.html).

### ***Lighting for Tomorrow***

DOE is one of the organizing sponsors of Lighting for Tomorrow (LFT), along with the American Lighting Association and the Consortium for Energy Efficiency. Lighting for Tomorrow is a design competition that encourages and recognizes excellence in design of energy-efficient residential light fixtures. In 2006, an SSL competition was added to the existing program for CFL-based lighting fixtures. Winners of the initial SSL competition were announced in December, including kitchen undercabinet light fixtures, portable

desk/task lights, and outdoor lighting, all using white LEDs as the light source. Winning companies included Progress Lighting, American Fluorescent, Lucesco, and Lucere Lighting. Lighting for Tomorrow will continue in 2007, again with separate categories for CFL-based fixture families and LED-based fixtures. Information is available at [www.lightingfortomorrow.com](http://www.lightingfortomorrow.com).

### ***Technology Procurement***

Technology procurement is an established process for encouraging market introduction of new products that meet certain performance criteria. DOE has employed this approach successfully with other lighting technologies, including sub-CFLs and reflector CFLs. DOE plans to employ technology procurement to encourage new SSL systems and products that meet established energy efficiency and performance criteria, and link these products to volume buyers and market influencers. Volume buyers may include the federal government (FEMP, DLA, GSA), utilities, or various sub-sectors including hospitals, lodging, or retail. This activity is linked closely to the technology demonstrations described below. For more information and ongoing updates on technology procurement and demonstration activities, see: <http://www.netl.doe.gov/ssl>.

### **B. Supporting Tasks**

The pathways to market described above are underpinned by several supporting tasks. The results of these tasks feed directly into the pathway activities.

### ***Commercial Product Testing Program***

SSL technologies today are undergoing rapid change and improvements, and products arriving on the market exhibit a wide range of performance. There is a need for reliable, unbiased product performance data to allow potential users to compare SSL products to traditional technologies, to reveal technical and design problems, and to inform the performance expectations of the pathway activities, as well as the standards processes. DOE initiated the Commercial Product Testing Program with a pilot round in which four commercially-available LED-based lighting fixtures were tested for total luminous flux, luminous intensity, wattage, and color characteristics. The program was officially kicked off during a half-day workshop on October 27, 2006 and is testing 8 to 10 products per quarter. DOE allows test results to be distributed in the public interest for noncommercial, educational purposes only. Detailed test reports are provided to users who provide their name, affiliation, and confirmation of agreement to abide by DOE's "No Commercial Use Policy." For more information and ongoing updates, see: [http://www.netl.doe.gov/ssl/comm\\_testing.htm](http://www.netl.doe.gov/ssl/comm_testing.htm).

### ***Technical Information Network***

SSL is a rapidly changing technology and is new to many in the lighting and energy efficiency professions. To facilitate learning and promote ongoing emphasis on energy efficiency and quality in the deployment of SSL, DOE is establishing a technical information network. The network will involve energy efficiency program sponsors, utilities, lighting researchers and designers, and others with interest in lighting energy efficiency. The network will meet regularly to receive technical information about SSL,

and to provide feedback from the market, including retailers, builders, and consumers, on market needs and barriers. DOE has already developed a series of fact sheets addressing technical and applications issues related to use of white LEDs as a general illumination source. These fact sheets and web-based materials are updated regularly to reflect the rapid development of the technology, and new topics are under development. Members of the Network will adapt and disseminate these technical materials to their local constituencies. For more information and ongoing updates, see: <http://www.netl.doe.gov/ssl>.

### ***Technical Support for Standards***

Because LEDs differ significantly from traditional light sources, new test procedures and industry standards are needed to measure their performance. To help coordinate and accelerate the standards development process, DOE hosted workshops in March and October 2006 bringing together all of the relevant standard-setting organizations. New or revised procedures and standards are currently under development to measure luminous flux, luminous intensity, lumen depreciation, and color characteristics of white-light LEDs. The new standards are expected to be published in mid-2007. For more information and ongoing updates, see: [http://www.netl.doe.gov/ssl/standards\\_dev.html](http://www.netl.doe.gov/ssl/standards_dev.html).

### ***Technology Demonstrations***

DOE is planning SSL technology demonstrations in both the residential and commercial building sectors. Currently in the product and host site identification phase, the demonstrations are expected to be implemented later in 2007. These demonstrations will provide real-life experience and data involving SSL installations in various applications. DOE will verify performance of the selected SSL-based products, including measurement of energy consumption, light output, color consistency, and interface/control issues. The technology demonstrations will also play a critical role in the technology procurement process, providing the performance verification needed to secure large volume purchases of SSL-based products. For more information and ongoing updates on technology demonstration activities, see: <http://www.netl.doe.gov/ssl>.

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